

### **REMARKS**

Reexamination of the captioned application is respectfully requested.

#### **A. SUMMARY OF THIS AMENDMENT**

By the current amendment, Applicant basically:

1. Editorially amends the specification.
2. Amends the title at the request of the Examiner.
3. Amends independent claim 1.
4. Adds new independent claim 9 and new claims 10 - 14 dependent thereon.
5. Proposes the substitution of new drawings (see section B infra)..
6. Respectfully traverses all prior art rejections (see section C infra).

#### **B. PROPOSED DRAWING CHANGES**

In the attached new drawings proposed for acceptance, the figure numbering is amended so that originally numbered Figures 2A - 4K become Figures 2A - 2K, respectively.

Figure 2A - Figure 2J, previously described, illustrate a semiconductor device with a convex region provided on the upper surface of the ferroelectric layer. It has previously been mentioned that the upper surface of the ferroelectric layer can have a convex or concave region.

New Figure 3 shows an embodiment in which the upper surface of the ferroelectric layer 14 has a concave region. It is extensively previously been mentioned that the upper surface of the ferroelectric layer can have a convex or concave region.

Whereas Figure 2A - Figure 2J illustrate the convex case, new Figure 3 illustrates the concave case and is amply supported.

New Figure 4 has been added and is supported, e.g., by original claims 3 and 4. Originally numbered Figures 5A - 6G are renumbered to become Figures 5A - 5G, respectively. Originally numbered Figure 7 becomes Figure 6.

Entry of the attached new drawings is respectfully requested.

### **C. PATENTABILITY OF THE CLAIMS**

Claims 1-4 stand rejected under 35 USC 102(b) as being anticipated by U.S. Patent 6,010,969 to Vaartstra. Claims 5 and 6 stand rejected under 35 USC 103(a) as being unpatentable over U.S. Patent 6,010,969 to Vaartstra. All prior art rejections are respectfully traversed for at least the following reasons.

Independent claim 1 has been amended to provide a semiconductor device comprising a capacitor formed on a flat surface of a semiconductor substrate. As previously, the capacitor comprises a lower electrode layer, a ferroelectric layer and an upper electrode layer, with a convex or concave region being formed on an upper surface of the ferroelectric layer. The amendment to independent claim 1 is supported, e.g., by the flat substrate 11 shown in Fig. 1.

The claimed constitution, a problem of peeling between the upper electrode layers and the ferroelectric layer can be suppressed when a capacitor is formed (i.e., when a deposit is washed after etching each of the layers and in a final annealing), as described, e.g., on page 4, lines 11-page 6, line 1 and page 7, line 2-page 8, line 9. Thus, the present invention is directed to solving the above layer-peeling problem in an uncovered device during a manufacturing process. The layers have a steep wall in the convex or concave region so that an "anchor effect" can be exerted to prevent peeling.

On the other hand, in the semiconductor device of Vaartstra (U.S. Patent 6,010,969), a ferroelectric material 11 and two electrodes 12 and 13 are formed on a generally undulating substrate as shown in the Fig. 1. Due to the undulating surface of the substrate, the above layers (i.e., the ferroelectric material 11 and two electrodes 12 and 13) naturally have concave and convex regions. Further, the layers have a gentle slope region between the concave and convex regions unlike the layers in the present invention. Therefore, the semiconductor device of Vaartstra exerts no or lessor anchor effect than the device according to the present invention. Further, Vaartstra does not exhibit any awareness to nor otherwise address this peeling problem.

Thus, the present invention of claim 1 is not anticipated by or obvious over U.S. Patent 6,010,969 to Vaartstra. The invention described in claims 2-4 is patentable because these claims depend from patentable claim 1.

Moreover other claims, such as claim 5, are separately distinguishable over U.S. Patent 6,010,969 to Vaartstra. As admitted by the Examiner, U.S. Patent 6,010,969 to Vaartstra presents no specific teaching with respect to the height or depth of any concave or convex region. As pointed out above, the thickness of ferroelectric layer 11 of U.S. Patent 6,010,969 to Vaartstra is essentially uniform. But the Examiner baldly opines that the claimed height/depth range would be obvious in discovering the optimum or workable ranges. Applicant disagrees.

In the above regard, the invention of claim 5 is directed to counteracting or resisting a deleterious peeling by which a top electrode of the capacitor has a tendency to separate and lift from an underlying ferroelectric layer. U.S. Patent 6,010,969 to Vaartstra does not exhibit any awareness to nor otherwise address this peeling problem. Rather, the thrust of the disclosure of U.S. Patent 6,010,969 to Vaartstra is finding a satisfactory method for depositing the ferroelectric layer 11 (*see*, e.g., col. 1, lines 32+;

col. 2, lines 36 - 40). Therefore, there is no suggestion in U.S. Patent 6,010,969 to Vaartstra regarding any particular range of height/depth of the convexity or concavity. Most certainly there is no teaching or suggestion in U.S. Patent 6,010,969 to Vaartstra regarding any particular range of height/depth of the convexity or concavity for a ferroelectric layer of non-uniform thickness.

As an aside, we wonder whether the peeling problem solved by our Applicants concerns a peeling that might otherwise occur in the finishing of the manufacturing process, or is the peeling possible subsequent to manufacture (e.g., during the life of a finished product). We wonder further whether the capacitor of the specification is ultimately encapsulated in the same manner as the upper electrode 11 of U.S. Patent 6,010,969 to Vaartstra is covered. We mention our wonderings because, if our Applicant's device remains uncovered and such uncovering makes the device more susceptible to peeling, it might be possible to advance a further patentability argument.

Further, Applicant's device is uncovered, while on the other hand the capacitor of U.S. Patent 6,010,969 to Vaartstra is encapsulated. Accordingly, U.S. Patent 6,010,969 to Vaartstra would naturally not face a peeling problem, and would have nothing to contribute for this further reason.

New independent claim 9 specifies that a convex or concave region is formed on the upper surface of the ferroelectric layer in a manner such that a non-smooth region on the ferroelectric layer upper surface is not aligned, in a direction perpendicular to a thickness of the ferroelectric layer, with a non-smooth region on the upper electrode upper surface. The subject matter of new independent claim 9 is not taught or suggested in the applied primary reference, since in undulations in U.S. Patent 6,010,969 to Vaartstra are aligned.

New dependent claims 10 - 14, dependent upon new independent claim 9, correspond to pending claims 2 - 6, respectively.

All pending claims are deemed patentably distinguishable over the applied art of record.

#### **D. MISCELLANEOUS**

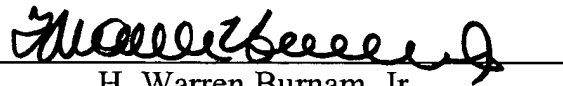
In view of the foregoing and other considerations, a formal indication of allowance is earnestly solicited.

The Commissioner is authorized to charge the undersigned's deposit account #14-1140 in whatever amount is necessary for entry of these papers and the continued pendency of the captioned application.

Should the Examiner feel that an interview with the undersigned would facilitate allowance of this application, the Examiner is encouraged to contact the undersigned.

Respectfully submitted,

**NIXON & VANDERHYE P.C.**

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